Claims

1. **(Currently Amended)** In a computer system, a method of encoding audio data comprising:

encoding a first portion of an audio data sequence in a direct variable-dimension vector Huffman encoding mode that uses escape codes to indicate changes between plural Huffman code tables for different dimensions;

switching to a run-level encoding mode at a switch point; and

encoding a second portion of the audio data sequence in the run-level encoding mode.

2. (Original) The method of claim 1 further comprising sending a flag in an encoded bitstream, wherein the flag indicates the switch point.

3. (Original) The method of claim 1 wherein the first portion of the audio data sequence consists primarily of non-zero quantized audio coefficients, and wherein the second portion of the audio data sequence consists primarily of zero-value quantized audio coefficients.

4. (Original) The method of claim 1 wherein the switch point is a pre-determined switch point.

5. (Original) The method of claim 4 wherein the pre-determined switch point is determined experimentally by testing efficiency of encoding the audio data sequence using the pre-determined switch point.

6. (Original) The method of claim 1 wherein the switch point is adaptively determined.

7. (Original) The method of claim 1 further comprising:

switching to a third encoding mode at a second switch point.

8. (Original) The method of claim 1 wherein the run-level encoding mode comprises context-based arithmetic encoding of run lengths and levels.

9. (Original) The method of claim 1 wherein the run-level encoding mode comprises Huffman coding of run lengths and levels.

10. (Original) The method of claim 1 wherein the run-level encoding mode comprises vector Huffman coding of run lengths and levels.

11. (Original) A computer-readable medium storing computer-executable instructions for causing an audio encoder to perform the method of claim 1.

12-14. **(Canceled)**

15. **(Currently Amended)** In a computer system, a method of decoding audio data comprising:

decoding a first portion of an encoded audio data sequence in a direct variable-dimension vector Huffman decoding mode that uses escape codes to indicate changes between plural Huffman code tables for different dimensions;

switching to a run-level decoding mode at a switch point; and

decoding a second portion of the encoded audio data sequence in the run-level decoding mode.

16. (Original) The method of claim 15 further comprising:

prior to the switching, receiving a flag indicating the switch point.

17. (Original) The method of claim 15 wherein the first portion of the encoded audio data sequence consists primarily of non-zero quantized audio coefficients, and wherein the second portion of the encoded audio data sequence consists primarily of zero-value quantized audio coefficients.

18. (Original) The method of claim 15 wherein the switch point is a pre-determined switch point.

19. (Original) The method of claim 15 wherein the switch point is adaptively determined.

20. (Original) The method of claim 15 further comprising:

switching to a third decoding mode at a second switch point.

21. (Original) The method of claim 15 wherein the run-level decoding mode comprises context-based arithmetic decoding of run lengths and levels.

22. (Original) The method of claim 15 wherein the run-level decoding mode comprises Huffman decoding of run lengths and levels.

23. (Original) The method of claim 15 wherein the run-level decoding mode comprises vector Huffman decoding of run lengths and levels.

24. (Original) A computer-readable medium storing computer-executable instructions for causing an audio decoder to perform the method of claim 15.

25-27. (**Canceled**)

28. (Original) In a computer system, a method of encoding data comprising plural symbols, the method comprising:

encoding a first vector comprising a first number of symbols, wherein the encoding the first vector comprises:

selecting a first code table from a set of plural code tables based on the first number of symbols; and

representing the first vector with a code from the first code table; and

encoding a second vector comprising a second number of symbols, wherein the second number of symbols differs from the first number of symbols.

29. (Original) The method of claim 28 wherein the first number of symbols is greater than the second number of symbols, and wherein the first vector has a higher probability of occurrence than the second vector.

30. (Original) The method of claim 28 wherein the encoding the second vector comprises:

selecting a second code table based on the second number of symbols; and

representing the second vector with a code from the second code table, wherein the second code table differs from the first code table.

31. (Original) The method of claim 28 wherein the first code table comprises:

codes for representing probable vectors of a set of possible vectors having the first number of symbols; and

an escape code.

32. (Original) The method of claim 28 wherein the first number of symbols differs from the second number of symbols by a factor of 2.

33. (Original) The method of claim 28 wherein the second number of symbols is 1, and wherein the encoding a second vector comprises:

representing the second vector with a code obtained by a table-less encoding technique.

34. (Original) The method of claim 28 further comprising:

encoding a third vector comprising a third number of symbols, wherein the third number of symbols differs from the first number of symbols and the second number of symbols, and wherein the encoding the third vector comprises:

selecting a third code table based on the third number of symbols; and

representing the third vector with a code from the third code table, wherein the third code table differs from the first code table and the second code table.

35. (Original) A computer-readable medium storing computer-executable instructions for causing a computer perform the method of claim 28.

36. (Original) In a computer system, a method of decoding data comprising plural encoded vectors, the method comprising:

decoding a first vector, wherein the decoding the first vector comprises:

receiving a first code representing a first vector, the first vector having a first number of symbols;

looking up the first code in a first code table in a group of plural code tables;

determining whether the first code is an escape code;

if the first code is an escape code:

receiving a second code representing the first vector, wherein the second code is not included in the first code table; and

decoding the second code;

if the first code is not an escape code:

looking up symbols for the first vector in the first code table; and

including the symbols in a decoded data stream;

wherein the first number of symbols is a basis for whether the first code is an escape code or not an escape code.

37. (Original) The method of claim 36 wherein the decoding the second code comprises:

looking up the second code in a second code table in the group of plural code tables;

determining whether the second code is an escape code;

if the second code is an escape code:

receiving a third code representing the first vector, wherein the third code is not included in the second code table; and

decoding the third code; and

if the second code is not an escape code:

looking up symbols for the first vector in the second code table; and

including the symbols in the decoded data stream;

wherein the second code table differs from the first code table.

38. (Original) The method of claim 36 wherein the first vector comprises one symbol, and wherein the decoding the second code comprises:

finding the one symbol using a table-less decoding technique; and

including the one symbol in the decoded data stream.

39. (Original) The method of claim 36 further comprising:

decoding a second vector, wherein the second vector has a second number of symbols, and wherein the first number differs from the second number by a factor of 2.

40. (Original) A computer-readable medium storing computer-executable instructions for causing a computer perform the method of claim 36.

41-42. (**Canceled**)

43. (Original) In a computer system, a method of encoding audio data in a vector Huffman encoding scheme, the method comprising:

determining a Huffman code from a Huffman code table to use for encoding a vector of audio data symbols, wherein the determining is based on a sum of values of the audio data symbols; and

encoding the vector of audio data symbols using the Huffman code.

44. (Original) The method of claim 43 wherein the Huffman code is an escape code, wherein the vector of audio data symbols is an n-dimension vector, and wherein the escape code indicates that the n-dimension vector is to be encoded as x n/x-dimension vectors using at least one different Huffman code table.

45. (Original) The method of claim 43 wherein the determining comprises comparing the sum of values with a threshold, and wherein the threshold depends on a number of audio data symbols in the vector.

46. (Original) The method of claim 45 wherein the number of audio data symbols is 4, and wherein the threshold is 6.

47. (Original) The method of claim 45 wherein the number of audio data symbols is 2, and wherein the threshold is 16.

48. (Original) The method of claim 45 wherein the number of audio data symbols is 1, and wherein the threshold is 100.

49. (Original) A computer-readable medium storing computer-executable instructions for causing an audio encoder to perform the method of claim 43.

50-77. **(Canceled)**

78. **(New)** The method of claim 1 wherein the encoding the first portion of the audio data sequence in the direct variable-dimension vector Huffman encoding mode comprises:

determining a Huffman code to use for encoding a vector of audio data symbols, wherein the determining is based on the audio data symbols and on a sum of values of the audio data symbols; and

encoding the vector of audio data symbols using the Huffman code.

79. **(New)** The method of claim 78 wherein the Huffman code is an escape code, wherein the vector of audio data symbols is an n-dimension vector, and wherein the escape code indicates that the n-dimension vector is to be encoded as x n/x-dimension vectors.

80. **(New)** The method of claim 1 wherein the encoding the first portion of the audio data sequence in the direct variable-dimension vector Huffman encoding mode comprises changing from a higher dimension vector Huffman code table of the plural Huffman code tables to a lower dimension vector Huffman code table of the plural Huffman code tables for encoding a vector of values from the first portion of the audio data sequence when the vector of values is not assigned a Huffman code in the higher dimension vector Huffman code table.

81. **(New)** The method of any claim 1 wherein the encoding the first portion of the audio data sequence in the direct variable-dimension vector Huffman encoding mode comprises:

determining that a first n-dimension vector of values from the first portion of the audio data sequence is assigned a Huffman code in an n-dimension vector Huffman code table of the plural Huffman code tables, wherein n is at least 2, and wherein the n-dimension vector Huffman code table contains Huffman codes for fewer than all possible n-dimension vectors of values;

encoding the first n-dimension vector using the assigned Huffman code from the n-dimension vector Huffman code table; and

responsive to determining that a second n-dimension vector of values from the first portion of the audio data sequence is not assigned a Huffman code in the n-dimension vector Huffman code table:

adding an escape code indicating a change to a n/2-dimension vector Huffman code table of the plural Huffman code tables;

dividing the second n-dimension vector into two n/2-dimension vectors;

determining that the two n/2-dimension vectors are assigned Huffman codes in the n/2-dimension vector Huffman code table, wherein the n/2-dimension vector Huffman code table contains Huffman codes for fewer than all possible n/2-dimension vectors of values; and

encoding the two n/2-dimension vectors using the assigned Huffman codes from the n/2-dimension vector Huffman code table.

82. **(New)** The method of claim 15 wherein the decoding the first portion of the encoded audio data sequence in the direct variable-dimension vector Huffman decoding mode comprises changing from a higher dimension vector Huffman code table of the plural Huffman code tables to a lower dimension vector Huffman code table of the plural Huffman code tables when an escape code of the higher dimension vector Huffman code table is encountered in the encoded audio data sequence.

83. **(New)** The method of claim 15 wherein the decoding the first portion of the encoded audio data sequence in the direct variable-dimension vector Huffman decoding mode comprises:

determining that a first Huffman code of the encoded audio data sequence is an escape code of an n-dimension vector Huffman code table of the plural Huffman code tables, wherein n is at least 2, and wherein the n-dimension vector Huffman code table contains Huffman codes for fewer than all possible n-dimension vectors of values;

responsive to determining that the first Huffman code of the encoded audio data sequence is the escape code of the n-dimension vector Huffman code table, decoding a second Huffman code of the encoded audio data sequence using an n/2-dimension vector Huffman code table of the plural Huffman code tables.